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Importance of cardiac point-of-care ultrasound in the pediatric emergency department. case report

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Abstract
Cardiac point-of-care ultrasound (POCUS) can rapidly assess function and identify systolic heart failure (HF), an often-missed diagnosis. POCUS has the potential to expedite medical intervention, improving overall outcomes. There have been limited studies describing pediatric emergency center (EC) utilization of cardiac POCUS and its effect on outcomes in pediatric patients. *Objective.* To report a case of 9 Years old girl, medically free before who presented to the Emergency department with progressive generalized swelling of the face, lower limb, lower back, and genitalia associated with orthopnea and fatigability The case was reported with severe decrease left ventricle systolic function, LVEF 10% with dilated left atrium and left ventricle with mild mitral and tricuspid regurgitation. Estimated RVSP of 30 mmHg. No LVOTO and no RVOTO. There is multiple thrombosis, the biggest thrombus measured 8 x 8 CM. *Patient.* This case was presented to the ED at the age of 9 years in heart failure. Electrocardiography shows arrhythmia with Premature ventricular contraction and non-sustain ventricular tachycardia. Echocardiogram was done that showed left ventricle systolic function, LVEF 10% with dilated left atrium, and left ventricle with mild mitral and tricuspid regurgitation. Estimated RVSP of 30 mmHg. No LVOTO and no RVOTO. There is multiple thrombosis. *Conclusions and Outcome.* There is Limited literature on the use of point-of-care ultrasound especially cardiac in an emergency setting which is considered a cornerstone in the diagnosis and management of critical conditions we would like to guide the emergency physician to use point-care ultrasound as routine in suspecting cardiac cases. This case report was done to emphasize point care ultrasound in the emergency department for any critical case to help improve patient survival rate and decrease the mortality rate. Also, extend our scope of thinking regarding intracardiac thrombosis in the pediatric age group that presented with heart failure.

Keywords: POCUS, LV thrombosis, heart failure, cardiomegally, arrhythmias

Introduction

Point of care ultrasound in an emergency consider one of the most important tools in the diagnosis of various conditions that will make a huge difference in management and critical intervention without exposing patients to ionized radiation. Cardiac POCUS can be done as bedside, quick, pain-free imaging for guidance for rapid clinical decision [1, 7]. Cardiac point-of-care ultrasound has the potential to improve patient care, but its application to children requires consideration of anatomic and physiologic differences from adult populations, and corresponding technical aspects of performance [2, 8]. The term cardiac POCUS is used to describe ultrasound image acquisition and interpretation of cardiac structures by pediatric noncardiology clinicians to evaluate the size, systolic function, and/or physiology. The expectation is that cardiac POCUS involves a focused evaluation of the heart, performed at the bedside, to assist in rapid clinical decision-making and management. Cardiac POCUS does not include anatomic evaluation of CHD, which requires transthoracic echocardiography interpreted by a pediatric cardiologist [2, 8]. Cardiac point-of-care ultrasound (POCUS) has emerged as a potential solution to delayed diagnosis and treatment of heart failure in the emergency center.

Heart failure in the pediatric age group is low but associated mortality & morbidity is high. Heart failure is a failure of delivering oxygen demand to the body which lead to specific sign & symptoms including edema, respiratory distress, growth failure, and exercise intolerance [3, 9]. The causes of heart failure differ from adults that are commonly caused by coronary artery disease and hypertension.

The pediatric age group is usually caused by congenital heart disease and cardiomyopathy [3, 9].

A rare complication of cardiomyopathy is intracardial thrombosis [4]. Our case report chose to emphasize point-of-care ultrasound for early detection and management of heart failure consequences because of chest x-ray is not enough to give details about heart anatomy and function.

Case report

Our patient is 9 years old girl, medically free, who presented to our emergency department with generalized pitting edema that started on her face and then progressively downward to her sacral, genitalia, and lower limb that was associated with exercise intolerance and her usual daily activity. No hx of urinary symptoms. No hx of jaundice, abdominal distention, or, skin rash. History was unremarkable of using any medication or any herbal medication.Upon examination, she looks unwell, pale, thin, in respiratory distress, and tachypneic. Not dysmorphic.

Vital signs; Bp 107/97 mmHg, HR 76 beats/minutes, RR 28 breath/minutes, Spo2 98 % in R.A.

Cardiovascular examination shows Normal capillary refill of less than two seconds with normal peripheral pulse and normal heart sound in addition to murmur (Gallop).

chest examination shows Equal air entry with no additional sound. The abdomen was soft, and lax, with hepatomegaly four cm below the costal margin (liver span 12 cm). Pitting edema in both lower limbs that extend up to genitalia.

Initial laboratory findings showed:

Table 1

CBC	HGb 11.6 g/dl	PLt 256 10*9/L	WBC 7.8 10*9/L
Coagulation Profile	PT 19.1	PTT 40.3	INR 1.4
Troponin 0.052	CK 73		
Renal Function Test	Creatinine 62umol/L	urea 6.8 mmol/L	
Chemistry	Na 134 mmol/L	K 3.8 mmol/L	Ca 2.2 mmol/L

Negative urine dipstick

Chest X-ray done that showed cardiomegaly (figure 1).

Bedside point of care ultrasound showed multiple thrombosis in the left ventricle with no pericardial effusion with decreased contractility confirms by an electrocardiogram that showed sever decrease left ventricle systolic function, LVEF 10% with dilated left atrium and left ventricle with mild mitral and tricuspid regurgitation. Estimated RVSP of 30 mmHg. No LVOTO and no RVOTO. There is multiple thrombosis, the biggest thrombus measured 8 x 8 CM (Figure 2).

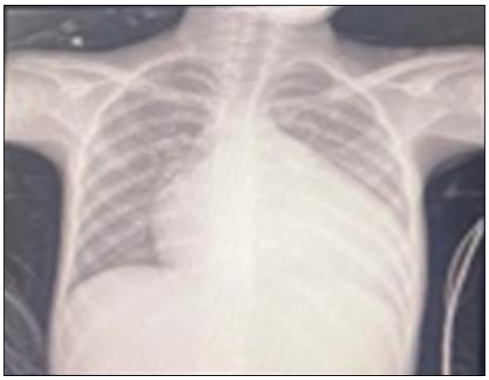

Fig 1

Fig 2

Discussion

Our case report evaluating not just the accuracy of POCUS but its impact on patient management and clinical outcomes in a pediatric emergency department. Cardiac POCUS has the potential to have a highly valuable role in the early diagnosis of acute systolic HF in children as a screening tool in conjunction with gold-standard tools such as echocardiography and other cardiac imaging. In the report, patients were able to get POCUS significantly sooner than conventional echocardiogram while still maintaining accurate findings [6]. Our report adds to the literature supporting the accuracy of pediatric cardiac POCUS in the hands of well-trained pediatric emergency medicine providers and is similar to their outcomes [6]. The only diagnostic discrepancy with contemporary echocardiography in our study was in a patient where the primary cardiac emergency was correctly identified, and the systolic function was mischaracterized. This rate of missed diagnosis is consistent with published literature regarding the accuracy of POCUS [6].

Here we are highlighting the importance of point-of-care ultrasound in a pediatric emergency setting as a quick diagnostic method that helps in blunt and penetrating abdominal and thoracic trauma by E-FAST. So, cardiac point-of-care ultrasound visualizes the heart with a closer look and any lung pathology which is important for the early management of life-threatening conditions.

So recommend to allow continuous improvement and training for better performance as recommended by the American Society of Echocardiology [2]. In our case presented with heart failure signs and symptoms associated with low ejection fraction and point care of ultrasound showed a huge thrombosis with poor contractility that is rarely seen in the pediatric age group. Cardiology was involved and advised to start inotropes, and anticoagulants and to be admitted to the intensive care unit for close monitoring and further investigation.

Hematology was involved to search for the etiology of thrombi such as protein C & S deficiency, antithrombin III & prothrombin gene mutation, and Factor V Liden deficiency. Neurology was involved to prevent further complication as stroke and advise to continue management of anticoagulant agents. In the pediatric intensive care unit (PICU) patients develop extravasation of the right arm with cellulitis that is treated by antibiotics. Heart failure is a failure of delivering oxygen demand to the body which lead to specific sign & symptoms including edema, respiratory distress, growth failure, and exercise intolerance [3].

The common cause of heart failure in the pediatric age group is cardiomyopathy complicated to intracardial thrombosis [4]. Case series done in King Faisal Specialist Hospital in Riyadh, Saudi Arabia which was published in 2020 found 9 cases of cardiomyopathy that complicated to thrombus which was treated with anticoagulant and compared the outcome [4]. The management of cardiomyopathy in the pediatric age group with an incidence of thrombosis that conclude the decreased ejection fraction exacerbates the risk of embolism [5].

Conclusion

This case report was done to emphasize point care ultrasound in the emergency department for any critical case to help improve patient survival rate and decrease the mortality rate. Also, extend our scope of thinking regarding intracardiac thrombosis in the pediatric age group that presented with heart failure.

Abbreviations

- POCUS: Point of Care Ultrasound
- EC: Emergency Center
- ED: Emergency Department
- HF: Heart Failure
- LVEF: Left Ventricular Ejection Fraction
- LVOTO: Left Ventricular Outflow Tract Obstruction
- RVOTO: Right Ventricular Outflow Tract Obstruction
- RVSP: Right Ventricular Systolic Pressure
- PICU: Pediatric Intensive Care Unit
- ECG: Electrocardiogram

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